REVOLUTION in the COLOR DARKROOM

rouble with color printing ven that it is just too darned lt for the average profes- to bother with. New ment changes that picture

ding to statistics published in *Dealer* magazine, a decade bout one out of five snapshots n color. Today half of amateur es are in color. This is truly volutionary change in an in- y.

e professional field is usually ght of as the vanguard for ical change in photography, n this case it lags far behind ank amateurs. When will the revolution hit the professional

the technical realm, which is ably less important than other rs such as photographer's atti- *PMI* thinks the answer de- s on two main factors: nega- calibration and processing pment.

terials cost is conspicuously t from this brief list. Material nts for but a very small part he total cost for professional photographs, be they black and e or color. One fact will make point clear. The price for a 3X ofinishing color print—includ- besides materials, the cost of essing, remakes, labor, trans- ation, dealer markup, overhead, t, etc.—is less than the lowest for an 8x10 black-and-white ever reported to *PMI* by an nt department.

cost of raw material is not key deterrent, neither is proc- g time. The photographer can make a color print of conven- al quality and permanence in less than eight minutes, with equipment costing under $200. Unless the photographer spends five to ten times that amount on specialized equipment, it is impossible for him today to duplicate that performance with black and white.

What hobbles color

As anyone who has made a color print knows, the difficulty lies in the complexity of color, brought about by the fact that three congruent images are employed. The variables involved with three images are many more than three times. One leading custom color finisher states it this way: "Our rejection rate for the first print is 100 percent." By his standards, it is impossible to get a truly professional print on the very first try. Because there are so many variables, there are so many chances for error that the print must be done over. This alone sends time and materials costs soaring. Were it possible to inexpensively control these variables before the print is exposed, a major stumbling block would be rooted out and smashed.

Up to the present time, color processing equipment for the small industrial darkroom has been both expensive, and inefficient in its use of the technician's time. The technician has been required to attend the processing equipment continuously during the processing cycle. With low-volume work, this implies a very high unit labor cost for processing. Furthermore access time for the detection of an exposure error is really a full processing cycle.

How the photofinishers do it

One factor which should simplify the problem for the photofinisher versus the professional is the level of acceptable quality. On the face of it professional pictures should be better than snapshots. Even the finest quality photofinishing print may be unacceptable for professional use because the photographer sees a chance to improve the subjective effect of a print which perfectly fits the highest pre-established standards of quality.

Nonetheless, modern photofinishing techniques do manage to turn out prints of a high level of quality, at a very low price. Photofinishing processing of color prints has been completely mechanized and fairly well automated. Pictures are made on continuous strips, which are automatically fed through the processing steps. The only operations for which people are required are in loading the spools of exposed paper and unloading the processed, dried prints. Mechanical cutters with touch, photocell or conducting mark sensing units cut the pictures apart.

In the matter of exposing the color print, photofinishing techniques rely far more heavily on automation than on mechanization. A jumbo printer is employed. Although paper feed is automatic, it is usually necessary for a person to handle the seemingly routine task of centering the negative, because so many variables are encountered there. The automation comes in the exposure of the negative. In a typical machine a beam-splitter deploys a certain amount of the exposing light to a set of three filtered photocells. They make an integrated reading, which is to say that each reads the combined light from practically all of the picture. One by one, as a predetermined amount of illumination comes through the negative, the exposing source is filtered, with filters the complement of the filter over the photocell. Together the system controls color balance and density. Override buttons usually

age 75)

are available to the operator to "bias" the automated exposure control, mostly for surround. In effect he cuts down the exposure of a figure on a snowy mountainside and increases the exposure of a picture made with flash at night. The system is in effect feedback automation employing the crudest of analog computers.

Additional override buttons are provided for remakes, based on the inspector's estimate of the proper correction for prints which turn out in the end to be below quality standards.

Rapid print process

The most dramatic recent change in the professional's situation is a recent development of the Eastman Kodak Company, the Kodak Rapid Color processors. These processors reduce the processing time for Ektacolor Professional Paper from 23 and 33 minutes to less than 8 minutes. Since, as was pointed out previously, for the professional, color processing time is in the main attended time, these are dramatic savings indeed. In Kodak's words, moreover, the quality and stability of the processed color prints are as good as those produced by any process. This sounds like encouraging news, and it is, but the situation bears looking into a little deeper.

The two processors are a 16-K model, billed as a professional machine and selling at $1250 with a maximum print size of 16 x 20, and a Model 11, which sells for "less than $200," and which processes 8 x 10 or 11 x 14 prints.

Both use a special abbreviated color processing kit, CP-5, and both employ the same processing technique, which Kodak describes as follows: "A hollow drum with a textured surface rotates at constant speed. The drum surface dip-contacts the processing solution in a shallow tray and is wetted uniformly as the drum rotates. An exposed enlargement is prewetted with water and laid emulsion up in an open-mesh blanket, then the blanket and paper are placed in contact with the drum. As the drum rotates, it brings fresh solution to the emulsion surface of the paper and provides a high degree of continuous agitation. Processing solutions are changed by simply tilting the shallow tray to dump, and then refilling with the new solution (4 oz. for the smaller processor and 8 oz. for the larger). Processing temperature is maintained (automatically in the larger machine) at 100F by a reservoir of water inside the drum. No special plumbing is required, and either model can be installed in a darkroom sink."

PMI has tested the machine and found that all claims regarding the evenness of agitation and the quality of the prints are quite true. The system is bound to change the minds of many thousands of photographers regarding the feasibility of producing color prints on premises.

While the system satisfies the first requirement of a color processing system, exact repeatability of results, it is definitely volume limited. With the larger machine, a photographer can achieve a maximum of 16 8x10s per hour—if he's really cracking. This cannot approach the production attainable with a conventional basket installation, much less the efficiency of the modern photofinishing process, but it does offer for the first time a generally acceptable solution to the high labor cost of processing small numbers of color prints.

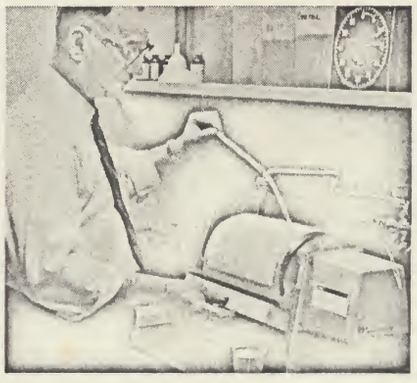
Experience indicates that loading the processor blanket and lowering the blanket and print onto a spinning drum (in the dark as it must be) does take some dexterity, as does feeding the beast with chemicals and dumping them at precisely timed intervals. Tests are also something of a problem. With less than half an 11-by-14 sheet of paper under the blanket the machine runs into some friction difficulties. Furthermore developing activity varies inversely with the number of square inches of exposed paper presented to the solution. The latent image decay characteristics of the paper require a consistent delay between time of exposure and time of development (unless you wait overnight, say) if the test is to be perfectly valid, so ganging a number of tests onto a single sheet of paper poses some problems too.

As this is written some photographer is probably working out a system to feed and dump chemicals into the machine automatically, thus reducing attended time to a minute or so and greatly improving the effective efficiency of the machine. Other possible improvements in the application of the excellent principle of heated-drum agitation, such as a transport system, could simply eradicate the relative advantages of black and white in print processing.

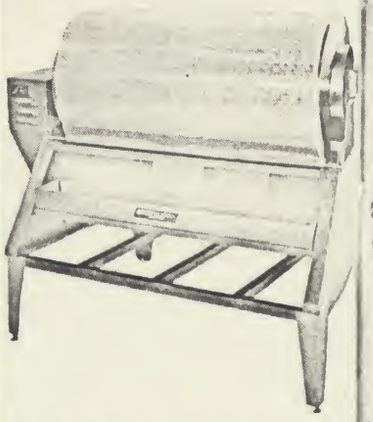
Exposure the key

No matter how efficient processing becomes, the revolution the

Kodak Rapid Color Processor, Model 16-K, processes two 8 x 10s or a 16 x 20 in less than eight minutes.



Model 11, designed for amateurs, is used here in a newspaper darkroom for rapid prints to 11 x 14 size.



Idea of drum agitation is incorporated in large Rolor Drum Processor for the Rapid Print Process.

s black and white out of its minant position in the indus- darkroom must sweep in effi- ways to predict the right balance of a print, ways low h in cost to appeal to the e professional.

e sky solutions have been ad- d, though certainly not with verage professional in mind. such is the Hazeltine color zer. It uses a color television n to preview a negative. es in the balance of the TV are automatically translated changes on the color head of larger.

e standard thus far in pro- nal color printing is the easel g photometer, made possible properly selected photomulti- tubes.

ements in these devices in- a system to simultaneously balance through three filters three phototubes. This has offered to correct the problem anted color absorbtion in the used in the head of the en- . Ordinary practice requires ding after each change in balance filtration through red, and blue reading filters, to any errors in the color bal- filters. Theoretical perfection call for an infinite series of dings.

more pressing difficulty for printers seems to be finding ea of the negative that can d to make an accurate read- Such familiar objects as flesh, or blue sky, may not be in icture to serve as a criterion, ey may give a misleading r. There is quite a difference e color of the cheek of a sun- burned man and a fashion model wearing heavy makeup.

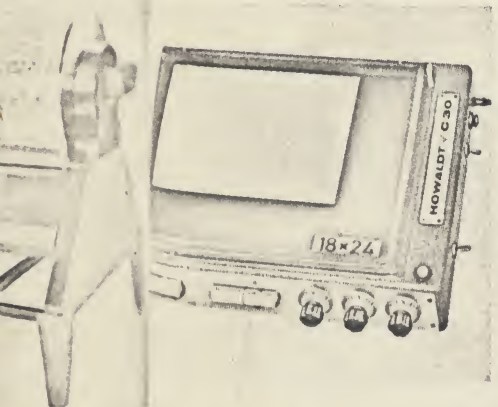
Integration

In contrast to the system of the color printer calling his shots by taking a pinpoint reading, the approach employed by the photofinishing trade has been applied to the problem of filtering the color negative. This approach assumes that all the colors in a color picture add up to a neutral gray, which turns out to be true for the average picture, particularly since most objects in nature are pretty desaturated in color. Some of the easel reading photometer equipment has long offered the printer the option of balancing for an over-all, integrated version of his negative.

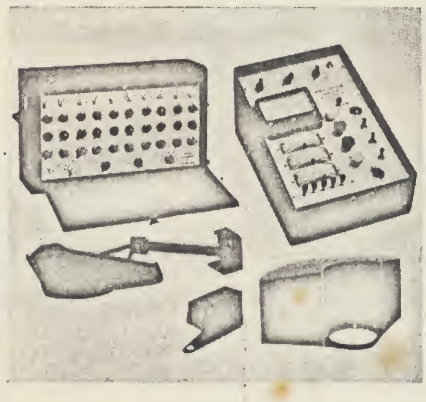
This approach has been carried out all the way to the automation of the photofinishing jumbo printer in two color exposure devices now on the market.

The first system introduced was the LogEtrol Color Controller. It has three main elements, a light-integrating easel, a control panel, and filter flippers. The light integrating easel consists of three photomultipliers mounted under a standard easel, which permits variable masking of 5 x 7, 8 x 10 and 11 x 14 prints. The three photomultiplier tubes are each filtered to be sensitive to the red, green, and blue light of the diffused light passing through the central 4 x 6 inch area of the printing paper mounted above them. The easel also contains three graduated potentiometers which permit the operator to preset the system to the particular paper emulsions in use. A separate color control panel receives the electrical output of the photomultipliers and transmits signals to the three filter solenoids in the filter flipper. The filter flipper is designed to fit under the lens of any standard enlarger. The quantity of light needed to trigger each filter is determined by the easel potentiometers. The potentiometers may be overridden by dials on the control panel for each of the filters and an additional dial to change density. The override is calibrated in CC02 units. Except when the override is dialed in, the print exposure is completely automatic. Among other things the unit is said to be insensitive to changes in voltage and lamp condition. Obviously it requires less decision making on the part of the printer than does the use of an easel reading photometer. For a report on its effectiveness in practice, see page 38 of this issue.

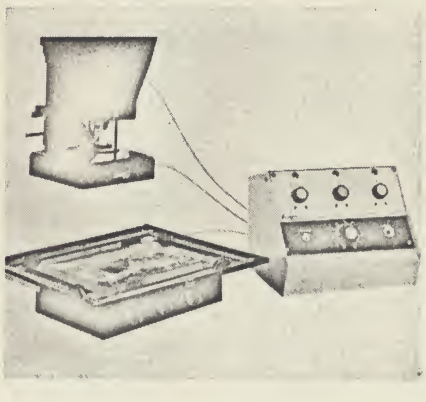
A similar system is employed in the Howaldt C30 Automatic Electronic Exposure Apparatus for color enlargements up to 9½ x 11¼. Attenuators and pushbutton controls are all housed in the easel. The operation of the device is described as follows: "By pressing a starting button, the blue filter in the filter head is moved into the path of the illumination above the negative. When in place, the light is switched on and extinguished after the predetermined amount of light through the paper in the easel. The process continues automatically for two other filters." There is provision to match the amount of illumination for each color to the requirements of the paper and process as well as to override for color and density. □



Howaldt C30 uses through-paper g system to regulate filters in head of enlarger.



Lektra Labs easel reading densitometer makes simultaneous three-color readings of projected image.



LogEtrol unit reads the color balance through the print paper during exposure, flips filters under enlarger lens.